THE UNIVERSITY OF KANSAS
SCIENCE BULLETIN

VOL. XXIX, pt. II.] OCTOBER 15, 1943 [No. 4

A New Meadow Mouse (*Microtus ochrogaster taylori*) from Meade County, Kansas

By CLAUDE W. HIBBARD and GEORGE C. RINKER,
University of Kansas Museum of Natural History

ABSTRACT: A new meadow mouse, *Microtus ochrogaster taylori*, nov. subsp., is described from Meade county, Kansas. The type and paratypes were collected from a bog area in association with *Cryptotis parva parva* (Say), *Reithrodontomys megalotis aztecus* (Allen) and *Peromyscus maniculatus* cf. *nebrascensis* (Coues).

THE Kansas University Museum of Vertebrate Paleontology field party has been collecting vertebrate fossils each summer since 1936 in Meade county, Kansas, and surrounding area. Until the summer of 1941 the only species of Recent microtines collected from that area was *Ondatra zibethica cinnamomina* (Hollister). In the summer of 1941 a good series of *Synaptomys cooperi paludis* Hibbard and Rinker was taken from a bog area in Meade county. During the past six summers all valleys, pastures and meadowland covered with bluestem, side oats gramma (*Bouteloua curtipendula* Michx.) or any of the tall grasses had been examined for signs of *Microtus*. All owl pellets found had also been examined, and no signs whatsoever had been observed of this genus.

Henry H. Hildebrand, a member of our field party for the past two summers, returned to his home just north of Fowler, Kansas, at the time University classes were out in the spring of 1942, and before our party left for the field. Since there was a large bog on the Hildebrand farm he endeavored to trap a series of *Synaptomys* from the area. His first night's catch yielded a single *Microtus*, and to him belongs the entire credit of locating the colony. When the party arrived in the field, we made plans to trap this area as soon as our work permitted. Advantage was taken of two rainy days that kept us from our fossil work, which allowed us to take

the series of skins which form the basis of this paper. The specimens have been found to differ appreciably from other races in North America.

We are greatly indebted to the following persons for the loan of specimens used in this study: Mr. C. D. Bunker, Curator, University of Kansas Museum of Modern Vertebrates, Lawrence, Kansas; Mr. B. Patterson Bole, Jr., Curator of Mammals, Cleveland Museum of Natural History, Cleveland, Ohio; Dr. Karl P. Schmidt, Field Museum of Natural History, Chicago, Illinois; and Dr. G. C. Rinker of Hamilton, Kansas; also to Dr. Worthie Horr, of the Department of Botany, University of Kansas, for the identification of plants.

All drawings were made by Mrs. Frances Watson Horseman.

The new meadow mouse may be designated *Microtus ochrogaster taylori* subsp. nov.

Holotype. Female adult, skull and skin, No. 14126, collection of University of Kansas Museum of Modern Vertebrates; collected by George C. Rinker, June 17, 1942, from the bog area on the farm of H. H. Hildebrand, one and one-half miles north of Fowler, Meade county, Kansas.

Paratypes. Nos. 14107, immature male; 14108, immature male; 14109, adult female; 14110, subadult female; 14111, adult male; 14112, adult female, M_3 not normal; 14113, adult female; 14114, adult female; 14115, adult male; 14116, subadult female; 14117, immature male; 14118, immature female; 14119, adult female; 14120, adult male; 14121, adult female, M_3 not normal; 14122, adult female, M_3 not normal; 14123, adult male; 14124, immature female; 14125, immature male; 14127, adult female; 14128, adult male; 14129, adult female; 14130, adult male, M_3 not normal; 14131, adult male, M_3 not normal; 14132, adult male, LM_3 not normal; 14133, immature male; 14134, immature female, 14135, immature male; 14136, adult female.

Distribution. Type locality (see discussion).

Diagnosis. Larger than *Microtus ochrogaster ochrogaster* (Wagner). Measurements in millimeters of type; total length, 159; tail, 34; hindfoot, 20; ear, 11. The presence of the interorbital ridge distinguishes it from both *Microtus ochrogaster haydenii* (Baird) and *M. o. ochrogaster,* (see fig. I, A & B). Color distinct from the gray coloration of *haydenii,* and the grizzled appearance of *M. o. ochrogaster.*

Color of type. Summer pelage (June) back and rump show a predominance of hairs tipped with cinnamon, the presence of the black

guard hairs giving an effect of snuff-brown. Flanks and cheeks paler than back; underfur of upper parts a dark neutral gray. Belly slightly washed with pale ochraceous-buff. An ochraceous-salmon spot is present at the base of the ear and in front of the fore limb on the side of the shoulder. Tail, above darker than back; below a darker ochraceous than the belly. Color nomenclature, Ridgway, 1912.

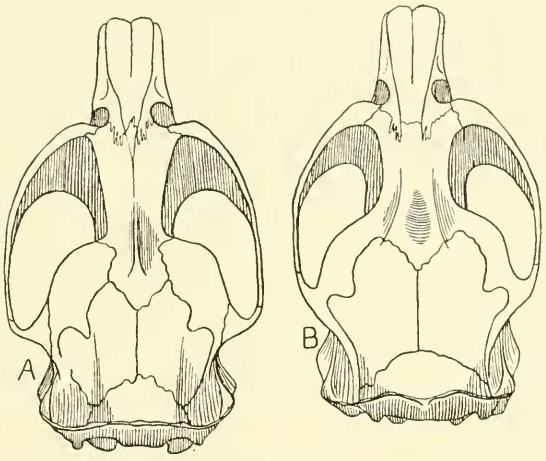

FIG. 1, A. *Microtus ochrogaster taylori subsp. nov.,* holotype, Kansas University Museum of Modern Vertebrates No. 14126, adult ♀. Dorsal view of skull, × 2.

FIG. 1, B. *Microtus ochrogaster ochrogaster* (Wagner), topotype, Cleveland Museum of Natural History No. 13599, adult ♂. New Harmony, Posey county, Indiana. Dorsal view of skull, × 2.

Skull and dentition of type. Skull similar to *Microtas o. haydenii* though not as long or as wide, when compared with specimens of the same size, and upper incisors not as heavy. The temporal ridges meet posterior to the interorbital constriction and a pronounced interorbital ridge is present, a character not common in *M. o. ochrogaster* or *haydenii.* Measurements in millimeters; condylonasal length, 28.3; basilar length of hensel, 24.4; greatest zygomatic breadth, 16.3; diastema, 8.5; width of upper incisors, 2.4; maxillary tooth row, 6.5; mandibular tooth row, 6.4; greatest width of lower jaws measured across tip of angles, 13.0. Upper and lower dentition normal, see fig. 2, A. & B.

The subspecies is named in honor of Doctor Edward H. Taylor of the University of Kansas.

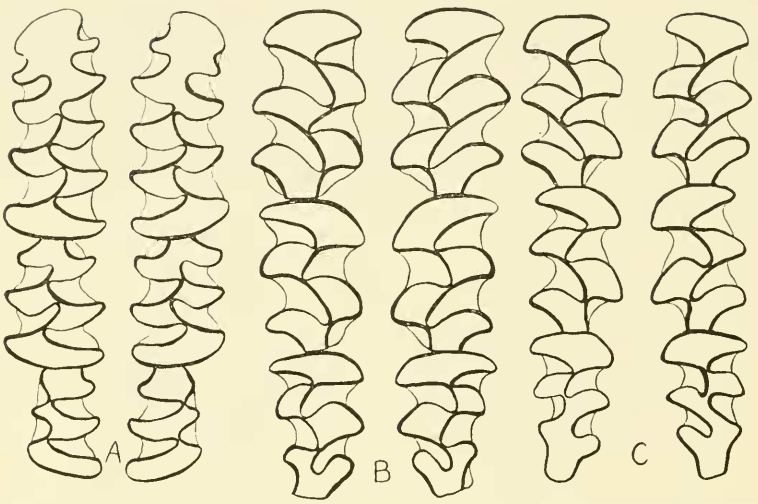

FIG. 2. Teeth of *Microtus ochrogaster*. A. *Microtus ochrogaster taylori* subsp. nov., holotype. Occlusal view LM_1-M_3 and RM_1-M_3. B. *Microtus ochrogaster taylori* holotype. Occlusal view RM^1-M^3 and LM^1-M^3. C. *Microtus ochrogaster ochrogaster* (Wagner), topotype, Cleveland Museum of Natural History, No. 13599. Occlusal view of RM^1-M^3 and LM^1-M^3. All $\times 10$.

Variation in paratypes. The paratypes range in size from an immature male, length 105 mm., to an adult male with a length of 180 mm. Immature coloration not greatly different than that of the type, the back and rump showing more of the dark neutral gray of the underfur because of the shortness of the guard hairs. The coloration of the adults varies in two extremes from the type. One adult is a light snuff-brown in appearance due to the lack of numerous black-tipped guard hairs. Five of the specimens show a slightly gray effect upon close examination, one being nearly as light as *M. o. haydenii* but distinctly separated by the light cinnamon-wash present throughout back, rump and sides. Fourteen adult specimens conform in coloration to the type. One male is slightly darker, due to the greater number of black tipped guard hairs. The bellies vary slightly from near silver with a faint wash of ochraceous to a darker ochraceous than that possessed by the type.

A series of four adults and three immatures were collected by Henry Hildebrand, December 24 and 26, 1942, from the type locality. At the same time he also caught ten specimens of *Cryptotis p. parva* in their runways. This series in winter pelage, in comparison with the type, which is June caught, has a denser fur, the back and rump

darker, with the cinnamon tipped hairs richer in color and not bleached as in the summer caught specimens; bellies with greater amount of ochraceous buff.

In comparison with winter specimens of *Microtus ochrogaster* from eastern Kansas, winter specimens of *M. o. taylori* are distinct due to the lack of gray tipped hairs. Fur slightly longer.

Of the thirty skulls of *M. o. taylori*, six possess M_3's with pattern showing variation from the normal (see fig. 4, G. & H.).

Average and extreme skull measurements (in millimeters) of the type and twenty-one paratypes, consisting of eight adult males and fourteen females, of which one is immature and one subadult; condylonasal length, 28.0 (24.2-30.7); zygomatic breadth, 16.49 (14.5-

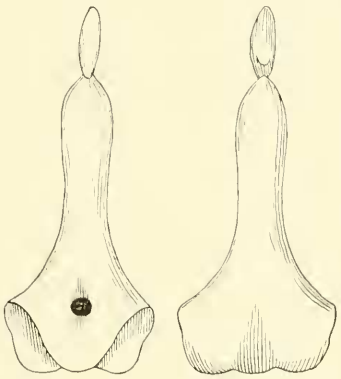

Fig. 3. *Microtus ochrogaster taylori*. Baculum, ventral and dorsal view, × 12.

17.3); nasals, 7.1 (6.5-8.4); diastema, 8.2 (6.6-9.15); maxillary tooth row, 6.5 (6.0-7.1); mandibular tooth row, 6.5 (5.9-7.0); greatest width of lower jaw measured across tip of angles (15 specimens) 13.2 (11.5-15.0). For external measurements see Table I.

A series of bacula were saved and prepared for study in the laboratory. The base differs considerably from that of *Synaptomys* (see fig. 3). At the anterior tip of the shaft is a second small bone attached to the main shaft by connective tissue. Special care was taken in cleaning the bacula and only a median element was found and no evidence of lateral ossifications. In the immature males the median bone at the tip of the shaft had not been formed although a tissue mass occupied its position.

Comparison of Microtis ochrogaster taylori with other M. ochrogaster. A series of seven adult topotypes of *M. o. ochrogaster,* three

males and four females, from New Harmony, Posey county, Indiana, in September pelage, was used for comparison. The color of these specimens is darker, possessing a definite grizzled appearance on rump, back and head due to the light tipped hairs in contrast to the black tipped guard hairs. The type of *M. o. taylori* lacks the grizzled appearance. The skulls of these specimens are not as robust, the temporal ridges do not converge to form a single orbital ridge as in *M. o. taylori* but the ridges extend across the orbit producing a shallow groove between them. The anterior part of the brain case does not form as sharp an angle in relation with the rostrum as in *M. o. taylori* (see fig. I, A & B). The measurements in millimeters of the seven adult topotypes of *M. o. ochrogaster,* nos. 13592, 13595, 13598, 13599, 13603, 13604, 13605, of the Cleveland Museum of Natural History collection are as follows: condylonasal length, 26.1 (24.3-27.2); zygomatic breadth, 14.4 (13.1-15.85); nasals, 7.1 (6.9-7.5); diastema, 7.5 (6.75-8.4); maxillary tooth row, 5.8 (5.5-6.2); mandibular tooth row, 5.7 (5.3-6.5); greatest posterior width of lower jaws measured across tip of angles, 10.9 (9.6-12.2). Upper and lower dentition normal. For external measurements see Table I.

M. o. taylori was compared with a series of *M. o. haydenii* from Rawlins county, Kansas, in July pelage and a single specimen, Field Museum, No. 21878, from Cherry county, Nebraska. *M. o. taylori* can be separated at once from *haydenii* which possesses a decidedly lighter grayish color and a silvery belly. Adult skulls of *haydenii* from Rawlins county average longer and broader and do not possess the strongly developed rostral ridge formed by the meeting of the

TABLE I.—Table of External Measurements of *Microtus o. taylori; M. o. ochrogaster; M. o. haydenii* and *M. ochrogaster* (in millimeters)

SPECIES.	Locality.	Total length.		Tail.		Hindfoot.		Ear.		No. measured.
		Average.	Extremes.	Average.	Extremes.	Average.	Extremes.	Average.	Extremes.	
M. o. taylori	Meade Co., Kans.	160.0	141.0–180.0	35.4	30.0–42.0	21.0	20.0–22.0	11.2	10.0–13.0	22
M. o. ochrogaster	Posey Co., Ind.	154.8	141.0–169.0	29.2	27.0–34.0	___	___	___	___	7
M. o. haydenii	Rawlins Co., Kans.	155.5	145.0–172.0	40.0	39.0–41.0	21.25	20.0–22.0	13.0	11.0–14.0	4
M. ochrogaster	Douglas Co., Kans.	150.0	142.0–165.0	34.4	29.0–40.0	___	___	___	___	19
M. ochrogaster	Greenwood Co., Kans.	154.8	142.0–181.0	35.0	29.0–46.0	___	___	___	___	16

temporal ridges as in *M. o. taylori*. Average and extremes of four adult males of *M. o. haydenii* from northeast Ludell, Rawlins county, Kansas; condylonasal length 28.8 (28.6-29.3); zygomatic breadth, 16.7 (16.0-17.5); nasals, 8.3 (8.2-8.4); diastema, 8.6 (8.4-9.1); maxillary tooth row, 6.3 (6.0-6.8); mandibular tooth row, 6.4 (6.0-6.6); greatest posterior width of lower jaws measured across tip of angles (one specimen) 13.0. Upper dentition normal; M_3 not normal in one specimen. For external measurements see Table I.

There is a single specimen of *M. ochrogaster*, No. 1066, in the K. U. collection from Logan county, Kansas, taken November, 1892. It is a specimen of an immature female, the skull compares well with that of *M. o. haydenii* though the pelage is badly bleached and appears to have been made from an alcoholic specimen, being of no value for comparative study.

A single specimen, K. U. No. 3498, taken July 18, 1921, at Coolidge in Hamilton county, Kansas, compares perfectly in coloration with that of the type of *M. o. taylori* but differs from the Meade specimens in that it does not possess the posterior interorbital ridge. Its skull is like those of a series of *Microtus ochrogaster* in the Field Museum collection taken three miles west of Alva, Woods county, Oklahoma. The December caught specimens from Meade county, possess a coloration like the specimens from Woods county which were taken February 21, and are in winter pelage. The measurements of six adults, four males and two females, from Woods county, Oklahoma, Field Museum specimens Nos. 6816, 6817, 6818, 6819, 6820, and 6821 are as follows; average and extremes, length of body, 147.5 (138.0-154.0); tail, 32.8 (30.0-38.0); condylonasal length, 27.0 (25.7-29.0); zygomatic breadth, 15.5 (14.6-16.4); nasals, 7.3 (7.0-7.9); diastema, 8.1 (7.5-9.0); maxillary tooth row, 6.3 (6.2-6.5); mandibular tooth row, 6.3 (6.1-6.6); greatest posterior width of lower jaws measured across tip of angles, 12.5 (one specimen). Upper dentition normal; one specimen with M_3 pattern showing variation from normal. The skulls of the Woods county specimens are distinct from those of *Microtus o. ochrogaster* and compare in from and size with those of *Microtus* taken west of the Missouri river, though none of the skulls possess the interorbital ridge present on the Meade county skulls. This character is not an age difference, though the ridge as a rule becomes more strongly developed in old adults possessing the ridge in subadult development. The Hamilton county, Kansas, specimen and the Woods county, Oklahoma, specimens are referred to *Microtus o. taylori*.

In the Kansas University Museum collection there are only five summer caught specimens from eastern Kansas, ranging from Doniphan county, in the extreme northeastern corner of the state to Cherokee county, in the extreme southeastern corner of the state. In coloration these specimens are distinct from the Meade county specimens and those of *M. o. haydenii* from Rawlins county. There is a slight change in colloration from north to south across the state but the series is too small to allow accurate comparison. They lack the snuff-brown appearance of *M. o. taylori.* In fact they compare

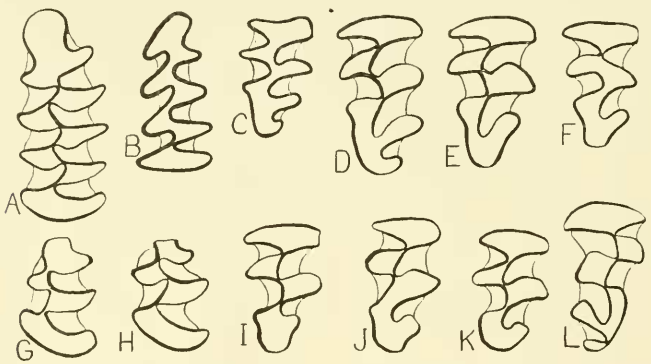

FIG. 4. Occlusal view of the teeth of *Microtus ochrogaster* (subspecies), showing variation in tooth pattern in eastern Kansas. A. No. 1038 Kansas University, LM_1 Douglas county. B. No. 1030 K. U., LM_1 immature, Douglas county. C. No. 1030 K. U., RM^3 immature, Douglas county. D. No. 4557 K. U., RM^3, Douglas county. E. No. 6819 Field Museum, RM^3, Woods county, Oklahoma. F. No. 1026 K. U., RM^3, Douglas county. G. No. 8041 K. U., LM_3, Greenwood co. H. No. 8042 K. U., RM_3, Greenwood county. I. No. 1080 K. U., RM^3, Douglas county. J. No. 3282 K. U., RM^3, Douglas county. K. No. 11831 K. U., RM^3, Rawlins county. L. No. 6819, Field Museum, LM^3, Woods county, Oklahoma. All $\times$ 10.

more nearly with the summer pelage of *M. o. ochrogaster* in that they show a grizzled effect which extends from the tip of the nose, throughout the upper parts but they possess definitely the *haydenii* type of skull. The eastern Kansas specimens seem to belong to a distinct race which is more closely related to *M. o. haydenii* than to *M. o. ochrogaster* based upon skull characters and not coloration.

In the Kansas University Museum collection there are 177 winter caught specimens of *Microtus ochrogaster,* chiefly from Douglas and Greenwood counties, (see map for localities from which specimens have been taken in Kansas). These specimens are distinct in coloration from the winter caught specimens taken near Alva, Woods county, Oklahoma, and the Meade county specimens. The measure-

ments of the sixteen largest adult specimens, nine males and seven females taken in Greenwood county, Kansas, are as follows: average and extremes, condylonasal length of skull, 27.2 (25.4-29.0); zygomatic breadth, 15.2 (14.15-16.3); nasals, 7.5 (7.0-8.2); diastema, 8.3 (7.0-9.0); maxillary tooth row, 6.09 (5.5-6.7); mandibular tooth row, 5.8 (5.2-6.2); greatest posterior width of lower jaws measured across tip of angles, 12.3 (11.4-13.0). For external measurements see Table I. Measurements of the nineteen largest adult specimens, six males, ten females and three of undetermined sex taken in Douglas county, Kansas, are as follows: average and extremes, condylonasal length of skull, 27.09 (25.3-28.7); zygomatic breadth, 15.66 (14.9-16.5); nasals, 7.5 (6.4-8.7); diastema, 8.4 (8.0-8.8); maxillary tooth row, 6.0 (5.6-6.5); mandibular tooth row, 6.23 (5.9-6.7); greatest posterior width of lower jaws measured across tip of angles, 12.5 (10.9-13.5). For external measurements see Table I. In 194 specimens from eastern Kansas, including twelve from Dr. G. C. Rinker's collection, 33 individuals possessed an M_3 with pattern showing variation from normal, (see fig. 4, G & H), two possessed a variation in pattern of M_1, (see fig. 4, A), and eight individuals possessed varied M^3 patterns (see fig. 4). The greatest percentage of variation in the M_3 patterns was found in specimens from southeastern Kansas.

From field notes and data on the specimens in the University Museum collection and Dr. Rinker's collection the following information upon the size and date of the occurrence of embryos found in females of *Microtus ochrogaster* are given in Table II. Records of embryos were not kept on the early collected females. The smallest recorded female containing embryos from eastern Kansas had a total length of 140.0 mm. while the largest female had a total length of 181.0 mm.

Food and habits of Microtus o. taylori. Due to the limited time close observations upon the food habits of *Microtus o. taylori* were not possible but they were found to be feeding chiefly upon the fox tail barley (*Hordeum jubatum* Linn.). Rolled oats and raisins were used as bait which was placed on snaptraps in their numerous runs in a patch of foxtail barley and where their runs came out of the dense growth of sedges. They took the bait readily and it was observed in their mouths and stomachs. Eight specimens were caught the evening of June 17 while the traps were being set. Sixteen were caught that night and eight more the night of July 10. Taken in the runs with the *Microtus* were two specimens of *Reithrodontomys megalotis aztecus* and 12 specimens of *Peromyscus maniculatus* cf.

TABLE II.—Record of Embryos of *Microtus ochrogaster*

DATE.	Number of embryos per female.	Stage of development.	Locality.
Jan. 14	3		Douglas county, Kansas
Jan. 29	5	4.0 mm	Douglas county, Kansas
Jan. 29	3	15.0 mm	Douglas county, Kansas
Jan. 29	3	Nearly full term	Douglas county, Kansas
Feb. 10	5	Large	Greenwood county, Kansas
Feb. 11	4	Small	Greenwood county, Kansas
Feb. 12	3	17.0 mm	Edmondson county, Kentucky
Feb. 12	3		Edmondson county, Kentucky
Feb. 13	3	27.0 mm	Douglas county, Kansas
Feb. 17	3	Very small	Greenwood county, Kansas
Feb. 17	5	Half term	Greenwood county, Kansas
Feb. 25	5	Large	Greenwood county, Kansas
Feb. 28	6		Douglas county, Kansas
Mar. 7	3		Greenwood county, Kansas
Mar. 15	5	One-third term	Greenwood county, Kansas
Mar. 18	5	Large	Greenwood county, Kansas
June 17	3	2.0 mm	Meade county, Kansas
June 17	2	10.0 and 4.0 mm	Meade county, Kansas
June 18	4	1.0 mm	Meade county, Kansas
June 18	3	Very small	Meade county, Kansas
June 18	2	38.0 mm	Meade county, Kansas
July 11	1	Full term	Meade county, Kansas
July 11	1	30.0 mm	Meade county, Kansas
July 11	5	25.0 mm	Meade county, Kansas
July 11	3	20.0 mm	Meade county, Kansas
Dec. 21	5	Two-thirds term	Greenwood county, Kansas
Dec. 23	4	Nearly full term	Douglas county, Kansas

nebrascensis. Cuttings and feces of *Synaptomys* were observed in the heavy growths of the large sedge (*Scirpus olneyi* Gray).

The habitat in which the *Microtus* were found is interesting. They were found on a rather dry area within a bog. The bog area is approximately 8 acres. The bog is located on the south side of Crooked Creek within the Crooked Creek valley near a point where the land gently rises toward the east. It is produced by deep-seated artesian springs which break through to the surface at this place. Due to the large amount of accumulated decayed vegetation the water seeps through at numerous places and no one place now offers a heavy flow. The following history of the bog is that given by Henry Hildebrand. At the time his family moved on to the place a small area of the bog (the highest part of land) had been drained by cutting lateral ditches around an area which allowed the seepage to enter the ditches. This area was approximately 200 feet long and nearly 100 feet wide. It had been placed under cultivation for raising garden vegetables. In 1925 Mr. Hildebrand began to ditch the entire bog area which was finished approximately during 1932, and he was able to confine the seepage and small flows to the ditches. They were so constructed that there were two large ones running parallel with numerous lateral ditches which ran out at right angles from the two main ditches. The bog was then placed under cultiva-

tion and truck farming was carried on in the area until 1938. During this entire time sedges were abundant along the ditches. In the summer of 1934 in burning off the trash the dried out bog material caught fire and one small area burned to a depth of at least one foot. Peat meadows were recognized in this area as early as 1878, for prior to this date peat had been dug and found to burn readily (First Biennial Report, Kansas State Board of Agriculture, p. 466, 1878). The fire smouldered for better than two weeks. It appears to have burned down to ground water level as this area now is covered chiefly by water and the tall sedge (*Scirpus validus* Vahl.). It is almost impossible to work one's way across this area since the burning of the peat has allowed the water table to rise. It was in this area that we found a nest of the western yellow-throat warbler and also observed numerous nests of the redwinged black-bird and yellow-headed black-bird. Bluewinged teal were observed and a king rail was heard calling. The bog has not been cultivated since 1938, which allowed the drainage ditches to become choked with vegetation and most of the area has reverted back to the original bog with the exception of the one high point which was first placed under cultivation. This area is rather dry and was thickly covered with foxtail barley in which were numerous runs of *Microtus*. The runs crossed many times and always led to the sedges growing along the area in the moist soil. It was in the sedges that their underground runs were found; two were found in the foxtail barley, but only one showed signs of habitation. It was impossible for *Microtus* to inhabit the area when it was under cultivation.

Bordering the bog is approximately a 60 acre plot of tall grass which was used as meadowland until 1937 when it was turned over to pasture. It has been grazed rather short and *Microtus* in this area would have been crowded into surrounding areas that would afford suitable cover and food, which may account for the large population observed when trapping. If the tall grass is the usual home of the *Microtus* in Meade county the population must be small and confined to rather isolated areas, since many acres of meadowland along Crooked Creek valley had been searched for signs of them in the past six summers.

Time was not available this past summer for the examination of surrounding meadowland or other bogs along Crooked Creek for the presence of *Microtus*, though it is definitely known that they do not occur in the Meade County State Park either in the extensive meadowland or in the bogs. In the Park are extensive areas of fox-

tail barley (*Hordeum jubatum)* which seem to offer a perfect habitat and are only inhabited by *Scalopus aquaticus intermedius* (Elliot), *Cryptotis p. parva, Reithrodontomys megalotis aztecus, Peromyscus maniculatus* cf. *nebrascensis* and *Sigmodon hispidus texianus* (Audubon and Bachman). This condition may be due to the fact that the park area is isolated from the Crooked Creek valley by a long stretch of sage brush and short grass. It seems that they should have been in the area before the building of the State Lake and the destruction of the habitat that existed along the tributary that ran into Crooked Creek.

The hot dry summers of the past eight years may have played an important part in their present distribution since the mammals of that area were not studied until after the peak of the development of the dust bowl. Dice (1922, p. 46) found that temperatures in excess of 98° F. were fatal to *Microtus ochrogaster* taken near Urbana, Illinois. If *M. o. taylori* is also affected by excess heat, it would account for the scarcity of the individuals in Meade county, and only those that were able to survive the drought would have found escape around suitable bog areas. Competition around these small oases must have been great during the peak of the drought. During the drought of 1936 we trapped areas in Meade county which appeared identical with the area trapped in Rawlins county, Kansas, that same summer where specimens of *M. o. haydenii* were obtained. The data at hand show clearly that *M. o. taylori* inhabits a much more moist habitat than *M. o. haydenii.*

Most of the meadows that would have furnished a suitable habitat for *Microtus* along Crooked Creek have been destroyed since the first settlement in 1877 in that valley. At the time of the settlement of Meade county extensive meadows and bogs occurred along Crooked Creek from a point approximately 4 miles south of Meade to a few miles upstream above Fowler, Kansas; at which time it was possible to go from Meade, Kansas, up Crooked Creek by boat to Fowler, Kansas. Draining of the area for agricultural purposes has destroyed these extensive meadows and bodies of water that existed in this area.

Ten of the females of *M. o. taylori* taken from the bog area contained embryos. The smallest female found to contain embryos had a total body length of 153 mm. For data concerning size and number of embryos see Table II.

Discussion. For the known distribution of *Microtus ochrogaster* in Kansas see map, fig. 5. All localities shown on the map are taken from Museum specimens except the following by Bailey (1900, pp.

74-75), Cairo, Onaga, Burlington, Pendennis and Banner, Kansas; Dice (1923, p. 48) Manhattan, Kansas, and Wooster (1938, p. 515) Hays, Kansas.

From the material available for study it is impossible to show areas of intergradation or the extent of the ranges of the subspecies within the state.

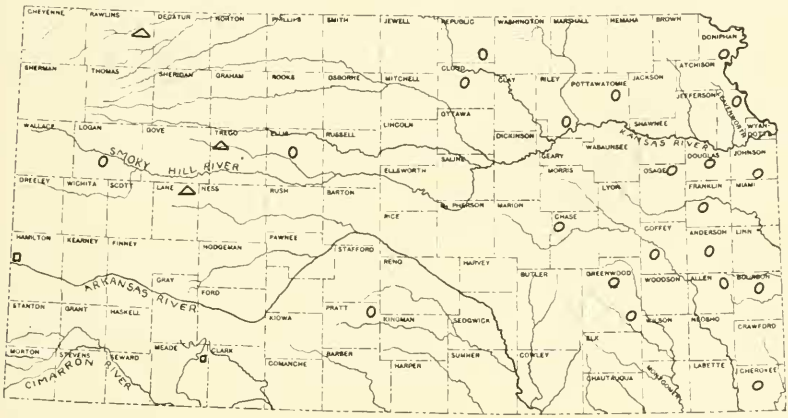

FIG. 5. Map of Kansas showing distribution of the subspecies of *Microtus ochrogaster* subsp.?. △, *Microtus ochrogaster haydenii* (Baird). □, *Microtus ochrogaster taylori* subsp. nov. ○, *Microtus ochrogaster* (Wagner).

Microtus o. taylori should be found throughout southwestern Kansas where suitable habitats exist. Whether the cranial difference, that is, the development of the rostral ridge, is due to an isolated stock is unknown but it is a common character of the Meade county specimens and separates them sharply from specimens of the same or larger size from Hamilton county, Kansas and Woods county, Oklahoma.

In the collection of fossils there are three fragmentary lower rami containing M_1 and M_2; two rami are from the Pleistocene of Meade county that are referred to *Microtus ochrogaster*.

Joe Tihen collected a fragmentary left ramus, No. 5971 KUMVP, bearing M_1-M_2 of an old adult from an eroded valley or sink hole fill along a tributary on the north side of Cimarron river on the XI Ranch, Meade county, Kansas, summer of 1940. The deposit from which the specimen was taken is considerably younger in age than the high terrace deposits at this locality. In the deposit are numerous snails and *Sphaerium*. In age it is very late Pleistocene or early Recent. The dentition compares well with that of the Recent

Microtus ochrogaster from Meade county though the M_1-M_2 series is slightly larger having an anteroposterior diameter of 5.25 mm., approximately the anteroposterior diameter of *Pitymys mcnowni* Hibbard from the Pleistocene of northeastern Kansas. Even though *P. mcnowni* possesses reëntrant angles of the same shape as those of *Pitymys*, it may prove, when sufficient material is at hand, to be a large form of *M. ochrogaster*.

A right ramus, No. 5191 KUMVP, containing M_1 and M_2, was taken from Locality No. 13, Meade county, Kansas, associated with the Jones Fauna. The anteroposterior diameter of M_1 and M_2 is 4.25 mm.

Another specimen of fossil *Microtus ochrogaster*, No. 6289 KUMVP, a fragmentary left ramus bearing M_1-M_2, comes from an older Pleistocene deposit in Lincoln county, Kansas, Locality No. 5. This specimen is intermediate in size between *Microtus ochrogaster* now found living in Kansas and *Microtus o. minor* (Merriam). We have been unable to compare the ramus with those of intermediate forms between the two subspecies. The anteroposterior diameter of M_1-M_2 in the fossil form is 4.4 mm. while the same diameter in the type of *M. o. taylori* is 4.6 mm. The reëntrant angles and closed triangles of this specimen appear more like those of *Pedomys* than those of *Pitymys*. The characters of these dentitional patterns are not sufficient to separate the fossil jaws from the subgenus *Pedomys* or the genus *Pitymys* with certainty.

REFERENCES

BAILEY, VERNON, 1900. Revision of American Voles of the Genus *Microtus*. North American Fauna, No. 17, pp. 74-75.

BOLE, B. PATTERSON, JR., and MOULTHROP, PHILIP N., 1942. The Ohio Recent Mammal Collections in the Cleveland Museum of Natural History. Sci. Publ. Cleveland Mus. Nat. Hist., vol. 5, No. 6, pp. 155-161.

DICE, L. R., 1922. Some factors affecting the distribution of the Prairie Vole, Forest Deer Mouse, and Prairie Deer Mouse. Ecology, vol. 3, No. 1, pp. 29-47.

———, 1923. Notes on the Communities of the Vertebrates of Riley county, Kansas, with especial reference to Amphibians, Reptiles, and Mammals. Ecology, vol. 4. No. 1, p. 48.

HILL, J. E., and HIBBARD, C. W., 1943. Ecological differentiation between two Harvest Mice (*Reithrodontomys*) in western Kansas. Jour. Mammalogy, vol. 24, No. 1, pp. 22-25.

WOOSTER, L. D., 1939. An Ecological Evaluation of Predatees on a Mixed Prairie Area in Western Kansas. Trans. Kansas Acad. Sci., vol. 42, p. 515.